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(54) **Frozen aerated confection**

(57) Frozen aerated confection having an overrun of above 80% and below 250%, and containing less than 0.5% w/w glycerol, freezing point depressants in an amount of between 25 % and 37 % w/w, and between 2 and 12% fat, wherein the freezing point depressants have a number average molecular weight $\langle M \rangle_n$ of less than 300 have a soft structure when eaten at -18°C.

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Description

Field of the invention

[0001] The present invention relates to a frozen aerated confection which is soft at -18°C and which contains less than 0.5 % (w/w) glycerol.

Background of the Invention

[0002] Trying to produce soft ice creams at -18°C has been the subject of many attempts which are all linked to the use of freezing point depressant compounds which make the product 'softer' by reducing the ice content of the product. GB 2019187 describes various 'soft' ice creams containing sugars and sugar alcohols having a molecular weight of less than 600. More particularly it describes a frozen aerated product, with an overrun of at least 140%, containing glycerol in an amount of 1 to 5%, sorbitol, fructose and invert sugar. GB 2019187 also indicates that as long as those low molecular weight sugars are present in the required quantities, the presence of higher molecular weight sugars has no impact on the 'softness' of the end product.

[0003] In general, these soft compositions present major drawbacks. First of all, owing to the sugars which are used, these products are extremely sweet and require the use of additives to suppress sweetness and/or, the use of very high overrun, and/or the use of significant amounts of glycerol which does not significantly contribute to the sweet taste but which generates a very noticeable off taste which consumers do not like.

[0004] Secondly, in order to try and quantify the softness of the ice cream, GB2019187 uses an Instron test, but it is submitted that this test does not really reproduce the mechanisms which take place in the mouth of a consumer having such an ice cream. It is particularly presented that compositions according to GB2019187 containing high molecular weight sugars are not satisfactory in terms of softness, nevertheless, when tested on Instron according to GB 2019187 they are fully within the teaching of GB 2019187. Therefore, GB 2019187 does not appear to fully resolve the single problem of producing a soft ice cream at typical freezer temperatures eg -18°C or below.

[0005] Therefore, the past attempts to produce ice creams to be consumed at typical freezer temperatures eg -18°C and having a normal overrun while not containing noticeable amounts of glycerol and not exhibiting a sweet taste while having organoleptic characteristics similar to soft ice creams which are typically consumed at temperatures of -8°C or warmer have not been successful.

[0006] There is thus a need for frozen aerated confections which will satisfy these criteria.

[0007] It has now be found that at a given ice content, it is possible to make the product softer by carefully selecting the sugars and particularly by avoiding high molecular weight sugars even in small quantities. It has also been found that, by carefully selecting the sugars, it is possible to make a remarkably soft product without having to use glycerol and without having to use additives to suppress sweetness. It has also been found that, with these new formulations, high overruns, in order to mask the sweetness, are no longer necessary.

Tests and definitions

Average molecular weight

[0008] For the purposes of this patent, the average molecular weight for a mixture of freezing point depressants (fdps) is defined by the number average molecular weight $<M>_n$ shown in the equation below. Where w_i is the mass of species i, M_i is the molar mass of species i and N_i is the number of moles of species i of molar mass M_i.

$$<M>_n = \frac{\sum w_i}{\sum (w_i / M_i)} = \frac{\sum N_i M_i}{\sum N_i}$$

Freezing point depressants

[0009] Freezing point depressants (fpds) as defined in this invention consist of:

- monosaccharides and disaccharides

- Oligosaccharides containing from 3 to ten monosaccharide units joined in glycosidic linkage.
- Corn syrups with a dextrose equivalent (DE) of greater than 20 preferably > 40 and more preferably > 60. Corn syrups are complex multi-component sugar mixtures and the dextrose equivalent is a common industrial means of classification. Since they are complex mixtures their number average molecular weight $<M>_n$ can be calculated from the equation below. (Journal of Food Engineering, 33 (1997) 221-226)

$$DE = \frac{18016}{<M>_n}$$

- erythritol arabitol, xylitol, sorbitol, mannitol, lactitol and maltitol.

Definition of overrun.

[0010] Overrun is defined by the following equation

$$OR = \frac{volume..of..ice..cream - volume..of..premix..at..ambient.temp}{volume..of..premix..at..ambient..temp} \times 100$$

Brief description of the invention

[0011] It is the object of the present invention to provide a frozen aerated confection having an overrun of above 80% and below 250%; preferably above 100%, containing;

- less than 0.5% w/w glycerol
- freezing point depressants in an amount above 25 % w/w and under 37 % w/w, preferably above 26% w/w, more preferably above 27% w/w , and
- between 0 and 15% w/w fat

wherein the freezing point depressants have a number average molecular weight $<M>_n$ of less than 300.

[0012] Preferably, the frozen aerated confection according to the invention contains at least 2% w/w fat.

[0013] Preferably the frozen aerated confection according to the invention contains less than 12% w/w fat, more preferably between 4 and 10% w/w.

[0014] Preferably the freezing point depressants have a number average molecular weight $<M>_n$ below 275 and even more preferably below 250. Even more preferably, the freezing point depressants have a number average molecular weight $<M>_n$ below 230.

[0015] The freezing point depressants are constituted at a level of at least 98% (w/w) of mono, di and oligosaccharides . More preferably, since fructose delivers a very sweet taste, the frozen aerated confection contains less than 5% w/w fructose, even more preferably less than 2.5% w/w fructose.

[0016] Preferably also the frozen aerated confection according to the invention contains less than 0.25% glycerol, even more preferably less than 0.1%. Preferably also, the frozen aerated confection according to the invention contains less than 10% w/w sorbitol, more preferably less than 5% w/w sorbitol.

[0017] Preferably also, the frozen aerated confection according to the invention contains more than 2% and less than 8% w/w proteins, preferably less than 6% w/w since it has been found that too high a protein content leads to a chalky, cheesy texture which should be avoided.

[0018] In a preferred embodiment of the invention the frozen aerated product has an overrun of less than 150%, more preferably less than 140%.

[0019] In another preferred embodiment of the invention the frozen aerated product has an overrun of more than 150%, more preferably more than 170%.

Detailed description of the invention

[0020] The present invention will be further described in the following examples wherein, unless indicated otherwise, the percentages are in weight by weight (w/w).

[0021] It should be noted that in the examples below the SMP (skimmed milk powder) is comprised of 50% (w/w) lactose and this needs to taken into account when calculating the total amount of freezing point depressants and the number average molecular weight $<M>_n$. Similarly, ingredients such as cocoa powder, whey concentrate, chocolate, fruit puree or juice, malt extracts also contain freezing point depressants that contribute to $<M>_n$.

[0022] Various ice creams were formulated and produced as follows and according to the following processing conditions:

[0023] Mixing - all ingredients are combined in an agitated heated mix tank. Once all ingredients have been blended together, the mixture is subjected to high shear mixing at a temperature of at least 65°C for 2 minutes in order to hydrate the stabilisers. Excessive temperature should however be avoided to prevent damage to heat labile components and the formation of cooked off flavours.

[0024] Homogenisation - the mix is then subjected to a homogenisation stage to reduce the bulk of the fat droplets to below 1μm. This is accomplished by homogenising the mixture using a valve homogeniser operating at a pressure of 150bar at a typical temperature of 70°C.

[0025] Pasteurisation - to conform to public health requirements the mix is subjected to pasteurisation treatment. The mix is heated to a temperature of 83°C and held for 20 seconds to achieve satisfactory treatment. The pasteurised mix is then rapidly cooled to chill temperatures, typically 4°C.

[0026] Ageing - The mix is held at chill temperature, typically 4°C.

[0027] The formulations of examples 7 to 12 were frozen using typical ice cream continuous freezers known at votators or scraped surface heat exchangers. These devices serve to freeze the mix and incorporate sufficient air to deliver the desired overrun. Although such devices usually deliver frozen ice cream at temperatures of -5°C to -7°C, the high levels of freezing point depressors in the formulations within this invention meant that the ice creams are typically frozen down to temperatures of -10 to -13°C.

[0028] Following freezing in a votator the ice cream is subjected to hardening process that reduces the temperature of the ice cream close to the final storage temperature.

[0029] Formulations of examples 1 to 6 were transferred from the votator to a cold extrusion device such as a single screw extruder where the ice cream can be further cooled under shear. Due to high levels of freezing point depressors the ice cream formulations disclosed in this invention will leave the cold extrusion device at temperatures of -20°C or lower.

Example	1	2	3	4	5	6
	% (w/w)	% (w/w)	% (w/w)	% (w/w)	% (w/w)	% (w/w)
SMP (Skimmed Milk Powder)	10	10	10	10	10	10
Butterfat	10	10	5	5	10	5
MGP (mono glyceryl palmitate)	0.3	0.3	0.3	0.3	0.3	0.3
LBG (locust bean gum)	0.2	0.2	0.2	0.2	0.2	0.2
Dextrose	15.2	15.2	17.3	15.3	21.7	17.3
Sucrose	7.6		8.65	7.65		
Corn syrup DE=63 83%solids		9.7			5	11
Water	56.6859	54.5859	58.5359	61.5359	52.7859	56.1859
Flavour	0.0141	0.0141	0.0141	0.0141	0.0141	0.0141
Average molecular weight	229	219	227	229	206	220
Overrun	135%	135%	135%	135%	135%	135%

Example	7	8	9	10
	%(w/w)	%(w/w)	%(w/w)	%(w/w)
Butter fat	4	4	4	10
SMP	8	8	8	10
MGP	0.15	0.15	0.15	0.3
Iota Carrageenan	0.2	0.2	0.2	
Vanilla				0.0141

(continued)

Example	7	8	9	10
	%(w/w)	%(w/w)	%(w/w)	%(w/w)
Vanillin	0.01	0.01	0.01	0.01
Sucrose	6.5	8.125	5.0	17.8
Lactose	3.5	4.375		
Dextrose	15.4	19.715	19.375	8.9
Water	62.04	55.22	63.065	52.79
LBG	0.2	0.2	0.2	0.2
Average Molecular weight	233	230	212	273
Overrun	100%	100%	135%	135%

Example	11
	%(w/w)
Coconut oil	7.0
Chocolate	2.0
SMP	3.74
Cocoa powder	7.0
Whey Conc. powder	3.84
Lactose	4.4
Dextrose	23.0
Sucrose	3.0
LBG	0.3
MGP	0.2
Colour	0.4
Water	45.12
Average Molecular weight	216
Overrun	200%

Example	12	13	14
	%(w/w)	%(w/w)	%(w/w)
Butter fat	4	4	4
SMP	8	8	8
MGP	0.15	0.15	0.15
Iota Carrageenan	0.2	0.2	0.2
Vanillin	0.01	0.01	0.01
Sucrose	15.5	11.5	19.27

(continued)

Example	12	13	14
	%(w/w)	%(w/w)	%(w/w)
Corn Syrup DE40	14	10.35	17.4
Water	57.94	65.6	50.77
LBG	0.2	0.2	0.2
Average Molecular weight	380	379	381
Overrun	100%	100%	100%

[0030] Examples 1-11 were considered to be soft and comparable to artisanal soft serve ice creams whereas comparative examples 12-14 were perceived to be much firmer.

Claims

1. Frozen aerated confection having an overrun of above 80% and below 250%, containing;

   - less than 0.5% w/w glycerol
   - freezing point depressants in an amount above 25 % w/w and below 37 % w/w, and
   - between 0 and 15% fat,

   wherein the freezing point depressants have a number average molecular weight $<M>_n$ of less than 300.

2. Frozen aerated confection according to claim 1 containing between 2% and 12% fat.

3. Frozen aerated confection according to claim 1 or 2 wherein the freezing point depressants have a number average molecular weight $<M>_n$ below 275.

4. Frozen aerated confection according to claim 3 wherein the freezing point depressants are constituted at a level of at least 98% (w/w) of mono, di and oligosaccharides .

5. Frozen aerated confection according to claim 4 containing less than 5 % w/w fructose.

6. Frozen aerated confection according to claim 1 containing less than 0.25% (w/w)glycerol, preferably less than 0.1% (w/w).

7. Frozen aerated confection according to claims 1 to 6 containing more than 2% and less than 8% proteins.

8. Frozen aerated product according to claims 1 to 6 having an overrun of less than 150%, preferably less than 140%.

9. Frozen aerated product according to claims 1 to 6 having an overrun of more than 150%, preferably more than 170%.

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EUROPEAN SEARCH REPORT

Application Number
EP 02 25 8414

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	1 April 2003	Boddaert, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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